

Department of Energy

§ 431.77

for oil-fired commercial warm air furnaces. In addition to the flue temperature measurement specified in Section 40.6.8 of UL Standard 727-1994, (Incorporated by reference, see § 431.75) you must locate one or two sampling tubes within six inches downstream from the flue temperature probe (as indicated on Figure 40.3 of UL Standard 727-1994) (Incorporated by reference, see § 431.75). If you use an open end tube, it must project into the flue one-third of the chimney connector diameter. If you use other methods of sampling CO₂, you must place the sampling tube so as to obtain an average sample. There must be no air leak between the temperature probe and the sampling tube location. You must collect the flue gas sample at the same time the flue gas temperature is recorded. The CO₂ concentration of the flue gas must be as specified by the manufacturer for the product being tested, with a tolerance of ±0.1 percent. You must determine the flue CO₂ using an instrument with a reading error no greater than ±0.1 percent.

(2) *Procedure for the measurement of condensate for a gas-fired condensing commercial warm air furnace.* The test procedure for the measurement of the condensate from the flue gas under steady state operation must be conducted as specified in sections 7.2.2.4, 7.8 and 9.2 of the ASHRAE Standard 103-1993 (Incorporated by reference, see § 431.75) under the maximum rated input conditions. You must conduct this condensate measurement for an additional 30 minutes of steady state operation after completion of the steady state thermal efficiency test specified in paragraph (b) of this section.

(d) *Calculations of thermal efficiency—*

(1) *Gas-fired commercial warm air furnaces.* You must use the calculation procedure specified in Section 2.38, Thermal Efficiency, of ANSI Standard Z21.47-1998 (Incorporated by reference, see § 431.75).

(2) *Oil-fired commercial warm air furnaces.* You must calculate the percent flue loss (in percent of heat input rate) by following the procedure specified in sections 11.1.4, 11.1.5, and 11.1.6.2 of the HI BTS-2000 (Incorporated by ref-

erence, see § 431.75). The thermal efficiency must be calculated as:

Thermal Efficiency (percent) = 100 percent – flue loss (in percent).

(e) *Procedure for the calculation of the additional heat gain and heat loss, and adjustment to the thermal efficiency, for a condensing commercial warm air furnace.*

(1) You must calculate the latent heat gain from the condensation of the water vapor in the flue gas, and calculate heat loss due to the flue condensate down the drain, as specified in sections 11.3.7.1 and 11.3.7.2 of ASHRAE Standard 103-1993, (Incorporated by reference, see § 431.75), with the exception that in the equation for the heat loss due to hot condensate flowing down the drain in Section 11.3.7.2, the assumed indoor temperature of 70 °F and the temperature term T_{OA} must be replaced by the measured room temperature as specified in Section 2.2.8 of ANSI Standard Z21.47-1998 (Incorporated by reference, see § 431.75).

(2) Adjustment to the Thermal Efficiency for Condensing Furnace. You must adjust the thermal efficiency as calculated in paragraph (d)(1) of this section by adding the latent gain, expressed in percent, from the condensation of the water vapor in the flue gas, and subtracting the heat loss (due to the flue condensate down the drain), also expressed in percent, both as calculated in paragraph (e)(1) of this section, to obtain the thermal efficiency of a condensing furnace.

ENERGY CONSERVATION STANDARDS

§ 431.77 Energy conservation standards and their effective dates.

Each commercial warm air furnace manufactured on or after January 1, 1994, must meet the following energy efficiency standard levels:

(a) For a gas-fired commercial warm air furnace with capacity of 225,000 Btu per hour or more, the thermal efficiency at the maximum rated capacity (rated maximum input) must be not less than 80 percent.

(b) For an oil-fired commercial warm air furnace with capacity of 225,000 Btu per hour or more, the thermal efficiency at the maximum rated capacity (rated maximum input) must be not less than 81 percent.